

WHAT IS CLAIMED IS:

- 1 1. A method for creating a multidimensional morphological
- 2 reconstruction of biological data characterizing a biological tissue sample comprising
- 3 the steps of:
- 4 cutting histologically thin sections of said sample to produce
- 5 first and second sets of alternating serial sample sections;
- 6 constructing a multidimensional morphological spatial matrix
- 7 of image data based on the first set of serial sample sections;
- 8 rasterizing the second set of alternating serial sample sections
- 9 into a multidimensional spatial grid of indexed tissue samples, with indices of an
- 10 indexed tissue sample indicating the location of the indexed tissue sample in the
- 11 multidimensional spatial grid;
- 12 analyzing each indexed tissue sample to obtain biological data
- 13 characterizing the indexed tissue sample; and
- 14 utilizing the indices of each indexed tissue sample to link the
- 15 biological data characterizing each indexed tissue sample to the location in the
- 16 multidimensional morphological matrix of image data corresponding to the indices of
- 17 the indexed tissue sample.

1 2. The method of claim 1 where said step of analyzing comprises the acts
2 of:
3 analyzing the tissue sample utilizing a monoclonal antibody binding to
4 determine levels of proteins and other ligands.

1 3. The method of claim 1 where said step of analyzing comprises the acts
2 of:
3 analyzing the tissue sample utilizing a micro array to determine levels of
4 mRNA

1 4. A method for creating a multidimensional morphological
2 reconstruction of gene expression activity in a biological tissue sample comprising the steps
3 of:
4 cutting histologically thin sections of said sample to produce first and
5 second sets of alternating serial sample sections;
6 histologically-staining and overslipping said first set of serial sample
7 sections for light microscopy;
8 utilizing the first set of histologically-stained serial sample sections to
9 construct a multidimensional morphological spatial matrix of image data;
10 mounting and covering the second set of serial sample sections with a
11 micro dissection membrane;
12 incising a grid pattern across each of the second set of serial sample
13 sections to form a plurality of incised grid element sections on each serial sample section;
14 providing a set of indexed grid element holders with indexes indicating
15 the identity of the serial sample section from which the grid element is incised and coordinate
16 indices indicating the location of the grid sample element in the identified serial sample
17 section;
18 transferring each incised grid element to the corresponding indexed
19 grid element holder so that the indexed grid element holders form a spatial array preserving
20 the location of the grid elements in the tissue sample;
21 analyzing each grid element to obtain (biological) gene expression
22 data;
23 utilizing the index data to spatially superimpose gene expression data
24 of each grid element onto the multidimensional morphological matrix of image data.

- 1 5. A method for creating a multidimensional morphological
- 2 reconstruction of gene expression activity in a biological tissue sample comprising the steps
- 3 of:
- 4 micro dissecting a tissue sample to obtain first and second sample sets of
- 5 tissue samples indexed to a 3-D grid;
- 6 processing the first sample set to obtain a computer generated 3-D
- 7 visualization of the tissue sample;
- 8 analyzing each sample in the second sample set to measure values of
- 9 biological data;
- 10 spatially mapping biological data values of samples in the second sample set
- 11 to corresponding indexed locations in the 3-D visualization.

- 1 6. The method of claim 6 further comprising the step of:
- 2 generating displays correlating values of biological data with corresponding
- 3 location in the 3-D visualization.